

## CLAIMS

### WE CLAIM AS OUR INVENTION:

1. A method of making an extruded snack food which includes the steps of:
  - (A) gelatinizing a corn meal with heat and moisture to form an extrudable raw material at an elevated temperature,
  - (B) transporting the raw material under pressure to the die extrusion gap of an extrusion die head,
  - (C) providing an extrusion die head construction of thermally conductive material,
  - (D) flowing the raw material through the die extrusion gap in a continuous stream so that the extrusion die head and the raw material tend to approach a common equilibrium temperature,
  - and,
  - (E) selectively cooling the extrusion die head to closely control the temperature of the extruding raw material,whereby the bulk density of the final extruded product will be controlled to achieve a targeted optimum value.
2. The method of Claim 1, wherein step (E) is effected by flowing a stream of water through the stator portions of the extrusion die head so that thermal energy is removed to a location remote from the die head by conduction.
3. The method of Claim 2, wherein the gross temperature of the raw material in step (A) is elevated to a temperature in the range of from about 350 to 360 degrees Fahrenheit.

4. The method of Claim 3, wherein the temperature of the stream of water is at least less than 350 degrees Fahrenheit.
5. For use in a food product extruding machine of the type having means for supplying glutinized corn meal to an extrusion die gap at a temperature elevated to a range of from about 350 to 360 degrees Fahrenheit for extrusion as a snack food,

the improvement of:

an extrusion die head having a die opening gap through which the extruding material passes,

said extrusion die head having stator means made of material which has sufficient mass, density and thermal conductivity so that it tends to form a heat sink which, in continuous extrusion operation, approaches the temperature of the extruding material passing there through,

water jacket means formed in said stator means of said extrusion die head,

and

a water supply system connected to said water jacket means to selectively flow a stream of water at lesser temperature than the temperature of the extruding material,

whereby the extruding material is temperature controlled as it passes through the extruder to a temperature at which bulk density of the final extruded product is optimized.

6. The extrusion die head of Claim 5 wherein

said water jacket means comprises a passage formed in said stator

means to extend in radially spaced relation to a center axis opening in said stator means and extending circumferentially from a pair of radially extending passages forming an inlet and an outlet.

7. The extrusion die head of Claim 6 wherein

said water supply system comprises a pump having its own reservoir, and conduit means from said inlet and said outlet connected to said pump and to said reservoir.

8. A food product extruding machine of the type defined in Claim 5, and further characterized by,

product flow processing means including bulk density sampling means receiving the extruded product from said die head,

said bulk density sampling means having means for generating a signal which is a function of final product bulk density,

and

programmable logic computer means to monitor, control and display the parameters of speed, head gap position, gross temperature, target moisture and feed rate of the machine,

said computer means operatively controlling the flow of water through said passage as a function of the bulk density of the final extruded product and the temperature of the extruding material.

9. In a programmable logic computer means for monitoring, controlling and displaying speed, head gap position, temperature, feed rate and target moisture in a

food extruding machine of the type wherein raw material is extruded to form a product,

the improvement of,

bulk density measuring means generating a control signal which is a function of the bulk density of the final extruded product,

and,

computer control means responsive to said control signal to regulate the flow of a cooling stream of water flowing through the stator means of a die extrusion head, thereby to control the temperature of the die extrusion head.

10. An extruding machine, comprising,

an extrusion die head having stator means with an axial opening surrounded by a water jacket,

a water system for selectively flowing water through said water jacket to control the temperature of the stator means,

product flow means forming a product stream to flow glutinized raw material at elevated temperature through said stator means of said die head and extruded product from said die head,

bulk density measuring means in said product stream to generate a bulk density signal of the final extruded product,

a programmable logic computer responsive to said bulk density signal,

and means in said water system subject to the control of said programmable logic computer to regulate the flow of water through said water jacket, thereby to control the temperature of the die head and the bulk density of the final product.

11. The method of manufacturing a food product in the group of food products which includes snack foods, Pastas, cereal and pet food, which method includes the steps of:

(A) heating a supply of selected raw material to a predetermined temperature at which the raw material constitutes a flowable glutinized mass,

(B) pressurizing the flowable mass to flow the raw material through the extrusion gap of a thermally conductive extrusion head , whereby the flowable mass and the extrusion head attain a common temperature,

and

(C) selectively cooling the extrusion head to regulate the temperature of the extruding raw material and to thereby control the bulk density of the final extruded product.

12. The method of claim 11 wherein the extrusion head is provided with a heavy metal stator means through which the material to be extruded passes, and, step (C) is carried out by flowing water through a water jacket passage formed in

the stator means.

13. A stator for a food extrusion head comprising,

a metal cylindrically shaped article having a longitudinally extending body with a radially extending circumferentially uniform flange at one end thereof,

a stator opening formed in said stator extending on the center line axis thereof from an inlet end to the face,

a water jacket spaced radially outwardly of the opening and its center line axis and inwardly of the outer periphery of said flange,

said water jacket being circumferentially discontinuous,

and,

a pair of radially outwardly projecting passages formed to extend outwardly from each corresponding end providing an inlet and an outlet to which a pressurized water system may be connected.

14. A stator as defined in claim 13, and wherein a water system is connected to said inlet and said outlet,

said water system comprising a circulating pump with its own water supply reservoir ,

and

a signal responsive regulator under the control of a PLC in control of said pump,

whereby the water system operates to drive water through the jacket under the control of the PLC.